

Method,” issued Mar. 4, 1997 to Kamimura et al., also discloses use of a fluorescent emission from a marking.

[0012] As examples of other identification or authentication systems, reference may be had to U.S. Pat. No. 6,373, 965 “Apparatus and Methods for Authentication Using Partially Fluorescent Graphic Images and OCR Characters,” issued Apr. 16, 2002 to Liang; and, U.S. Pat. No. 3,513,320 “Article Identification System Detecting Plurality of Colors Disposed on Article,” issued May 19, 1970 to Weldon. A further device is disclosed in an IBM Technical Disclosure Bulletin “Sequential-Readout Identification Tag” by Dickerson and Williams, Volume 17, No. 3, August 1974. This bulletin discloses a device intended for use as a tag usable for non-contact scanning according to wavelength.

[0013] Many of the foregoing instruments are limited to color detection and measurement. Typically, these instruments do not provide other capabilities necessary or desirable for the assessment of other aspects of security features. For example, many of these instruments are not equipped to determine a color and a shape of a security feature.

[0014] What is needed are methods and apparatus for making accurate assessments of the authenticity of at least one of the color, shape and size of security features included in a valuable item or substrate. For example, what is needed is a device that can reliably recognize narrow bands of wavelengths appearing in the ultraviolet (UV), visible (VIS), or infrared (IR) regions of the electromagnetic spectrum, and make rapid determinations regarding the security features. In addition, it would be useful to measure a plurality of security features, having diverse aspects such as multiple colors, sizes and shapes, and analyze combinations thereof.

SUMMARY OF THE INVENTION

[0015] These teachings are directed to a system for assuring security of documents and other similar substrate. Aspects of the invention disclosed herein include: use of security features with a substrate and a system for recognition of the security features.

[0016] The unique security features (or “particles”) are characterized by, among other things: having substantially no body color, or apparent body color, so as to be substantially “invisible” under visible light; precise and uniform appearance at various sizes; and, application techniques that provide for uniform loading and control over large areas.

[0017] The system includes a hand-held device collects an image of a substrate offered for authentication, and performs a number of steps to authenticate the substrate. These steps may include, without limitation: the de-mosaic and decimation of the image to produce a set of composite color pixels; calculation of background gray level; detection of the security features; analysis of the properties of the security feature; and, logic processing to ascertain the presence of a security code derived from the security features.

[0018] The system thus provides for an integrated technique to assure the authentication of documents and other valuable items.

[0019] One aspect of the teachings herein provides a method for authentication of a substrate that includes: generating a color image of the substrate that contains pixels; identifying at least one region of authentically colored pixels

by comparing the color of at least a portion of the pixels to a predetermined color in a first comparison test; determining at least one geometric aspect for the at least one region by counting pixels along a perimeter of the at least one region; comparing the at least one geometric aspect of the at least one region to at least one predetermined geometric value in a second comparison test; and authenticating the substrate if the first comparison test and the second comparison test are successful.

[0020] Another aspect of the teachings herein are a system for authentication of a substrate that includes: a source of authentication data comprising authentic color information and geometric aspect information, the authentication data derived from at least one color image of at least one authentic substrate comprising at least one set of security features; an imaging sub-system for producing a color image for authentication of the substrate; and, a processor coupled to the source of authentication data and coupled to the imaging sub-system, the processor adapted for comparing the color image to the authentication data and determining the authenticity of the substrate.

[0021] A further aspect of the teachings herein includes a method for providing calibration data for a system for authenticating a substrate that includes: selecting at least one authentic substrate having at least one set of security features; generating a color image of the at least one authentic substrate; analyzing the color image to determine color data for each set of security features and storing the color data as calibration data; and, analyzing the color image to determine geometric aspect data by counting pixels about the perimeter of individual security features in each set of security features and storing the geometric aspect data as calibration data.

[0022] Another aspect of the teachings herein includes a computer program stored on computer readable media, the computer program providing instructions for operation of a device adapted for authentication of a substrate by: generating a color image of the substrate, the color image comprising pixels; identifying at least one region of authentically colored pixels by comparing the color of at least a portion of the pixels to a predetermined color in a first comparison test; determining at least one geometric aspect for the at least one region by counting pixels along a perimeter of the at least one region; comparing the at least one geometric aspect of the at least one region to at least one predetermined geometric value in a second comparison test; and, authenticating the substrate if the first comparison test and the second comparison test are successful.

[0023] It should be recognized that some of the foregoing steps may be omitted or adapted as a result of modifications to the techniques disclosed in the embodiment presented herein.

[0024] For example, use of a sensor array other than the one disclosed herein may give rise to the adaptation of the foregoing color recognition steps.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The above set forth and other features of the invention are made more apparent in the ensuing Detailed Description of the Invention when read in conjunction with the attached Drawings, wherein:

[0026] FIG. 1 is a block diagram showing the major sub-components of a hand-held, portable, device for obtaining color measurement and analysis;